

TITLE: DRY MATTER PARTITIONING AND CHEMICAL COMPOSITION OF TOBACCO GROWN IN A GREENHOUSE WITH VARIOUS SUPPLEMENTAL LIGHT SOURCES

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ABSTRACT: Composition and morphological development of tobacco grown in a greenhouse during winter is greatly influenced by supplemental lighting. Burley tobacco seedlings were transplanted to large pots in mid-December and grown in a 25°C greenhouse with natural daylight alone or supplemented with illumination from metal halide, high pressure sodium, white incandescent, or cool white fluorescent lamps. Plants under all of the light sources received supplemental photosynthetically active radiation of $50 \pm 5 \mu\text{E} \cdot \text{cm}^{-2} \text{sec}^{-1}$ for 16 hours per day beginning at 8:00 am and ending at midnight. The control lot received only natural daylight. At 6 weeks after transplanting, wide differences existed in dry matter distribution among stalks, midveins and lamina of plants grown under the various light sources. Leaf area per plant also differed as did content of the nitrogenous fraction. All of the supplemental light sources were effective in delaying flowering until 30 or more leaves developed per plant in contrast with 15 leaves on plants that received only natural winter daylight in the greenhouse. Some plants from each of the light treatments were topped, hand suckered, and air cured. In general, plants grown under high pressure sodium and cool white fluorescent lamps were most similar to field plants. Those grown under the incandescent source had a higher percentage of their total dry matter in stalks and less in leaf lamina. Plants grown under the metal halide lamps developed smaller leaves than those under high pressure sodium or cool white fluorescent lamps. Differences among plants grown under the various supplemental light sources are attributed to the spectral distribution of the light, and indicate the importance of light source on relevance of winter experiments to potential field situations.

REVIEW: This paper reemphasized the differences between field grown and greenhouse tobacco and explored some of the different light sources that can be used in the greenhouse to duplicate the spectrum that sunlight provides. The light sources used covered the photosynthetically active range of 300-800 nm. Components such as soluble phenols and chlorogenic acid were measured in field grown Burley Kyla plants under filters that cut out the UV range of 0-320, and another using mylar film which cut out 0-400 nm. The soluble phenols and chlorogenic acid were greatest in plants grown in full sun, with decreasing values as more of the spectra was removed. This same trend was noticed with the four light sources used for winter greenhouse experiments. The 1) cool white fluorescent (CWF) which provided a spectrum of near UV, visible and far red, 2) the metal halide (MH) lamp which provided the near UV, blue, visible and red, and 3) the high pressure sodium (HPS) lamp which provided the near UV, visible, far red and near infrared, allowed plants to grow into medium height, sturdy plants. Greenhouse plants with incandescent supplemental light were tall and spindly with much more stem and stalk to lamina than plants grown under the other light sources. Incandescent light is very low in UV but ample in visible, red and far red. The total chlorophyll was more abundant with light sources that supply the near UV range of 300-320 nm. The carotenoids--neoxanthine, violaxanthin, lutein and β -carotene--were also higher in content in plants grown under CWF and MH light sources which provide the UV light.

This field of research needs further study to define the specific spectra and any other conditions needed to produce the quality of plant in the greenhouse that most nearly equals field grown tobacco. Cured, greenhouse grown tobacco was poorer in quality at every stalk position when compared to field grown plants according to official standard grades for burley tobacco. We need to be able to grow plants of reproducible quality regardless of season.

-Reviewed by V. Baliga

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